November 25, 2020

The Honorable Chair and Members of the
Hawai'i Public Utilities Commission
465 South King Street
Kekuanaoa Building, 1st Floor
Honolulu, Hawai'i 96813

Dear Commissioners:

Subject: Docket No. 2007-0341 – Review of Demand-Side Management Reports and Requests for Program Modifications – Hawaiian Electric Company, Inc. Modification and Evaluation Report

In accordance with Order No. 23717, filed October 12, 2007 in the subject proceeding, attached is Hawaiian Electric Company, Inc.'s ("Hawaiian Electric" or the "Company") Annual Program Modification and Evaluation Report ("M&E Report") for its Commercial and Industrial Direct Load Control ("CIDLC") program, Residential Direct Load Control ("RDLC") program, Fast Demand Response Pilot ("Fast DR") Program, and implementation of the Demand Response ("DR") Portfolio.[1]

The M&E Report provides information on 2021 forecasted grid services amounts, forecasted program budgets, and key activities for implementing the DR Portfolio. Hawaiian Electric requests Commission approval to: (1) Discontinue the quarterly expense reporting for the Commercial and Industrial Direct Load Control program in favor of annual reporting; (2) Allocate up to $750,000 in base rate variable expense in 2021 that would otherwise be reconciled and returned to Hawaiian Electric Commercial and Industrial ("C&I") customers to support the transition of existing EnergyScout program participants to new programs that offer grid services aligned to the IGP and DER Program Track, and; (3) Request to Use Hawaiian Electric C&I incentive budget that would be reconciled under the Demand Response Adjustment Claus to Transition Existing Commercial and Residential EnergyScout Program Participants. Please see page 3 of the M&E Report for additional information related to these requests.

Sincerely,

/S/ Kevin M. Katsura

Kevin M. Katsura
Director
Regulatory Non-Rate Proceedings

Attachment
c: Division of Consumer Advocacy

1 Subject to the Commission's Order No. 37043, Emergency Filing and Service Procedures Related to COVID-19, filed March 13, 2020.

HAWAIIAN ELECTRIC COMPANY, INC.
MAUI ELECTRIC COMPANY, LIMITED
HAWAI'I ELECTRIC LIGHT COMPANY, INC.

DEMAND-SIDE MANAGEMENT PROGRAMS MODIFICATION AND EVALUATION REPORT

November 25, 2020

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PREFACE

In its Demand-Side Management ("DSM") Program applications, Hawaiian Electric Company, Inc. ("Hawaiian Electric"), Maui Electric Company, Limited ("Maui Electric"), and Hawai'i Electric Light Company, Inc. ("Hawai'i Electric Light") (collectively, the "Hawaiian Electric Companies" or "Companies"), proposed to file two annual reports with the Hawai'i Public Utilities Commission ("Commission"):[1]

(1) The Modification and Evaluation Report ("M&E Report") filed by November 30th of each year; and
(2) The Accomplishments and Surcharge Report ("A&S Report") filed in March following the end of each calendar year.

The M&E Report is considered a prospective view of the DSM program(s) operations for the next calendar year and serves the following purposes:

- DSM Program(s) defined in this report as existing Demand Response programs and grid service programs executed by contracting with aggregators.
- Provides an updated forecast of the budgets and goals;
- Describes the modifications to the program(s) that the Companies propose to implement; and
- Provides the results of evaluation studies, which can also serve as the basis for potential modifications to budgets, goals, and program implementation strategy.

The A&S Report is considered a financial reporting of the DSM program(s)' performance from the prior calendar year and serves the following purposes:

- Documents the accomplishments of the DSM programs, including an accounting of the demand savings impacts, equipment installations, and recorded program expenditures;
- Reconciles revenue collected from the cost recovery surcharge adjustment. It also establishes new cost recovery factors for the DSM Surcharge component of the Integrated Resource Planning ("IRP") Surcharge; and
- Provides an update of the cost-effectiveness of the program(s) based upon recorded program expenditures and measure adoptions. The Companies expect to file their next A&S Report on or about March 30, 2021, in Docket No. 2007-0341.

[1] In Order No. 23717, filed on October 12, 2007, the Commission opened Docket No. 2007-0341 instituting a proceeding to review Hawaiian Electric's DSM reports and requests for program modifications, and ordered that such reports and requests be filed in the subject docket. This M&E Report is filed pursuant to that Order.

I. Background

On January 25, 2018, the Commission issued its Decision and Order No. 35238 ("D&O 35238") notifying the Companies that Commission approval of the proposed GSPA is not required before the Companies make final selections for the Request for Proposal ("RFP") No. 06175-02, and contract with Suppliers to allow for program start and participant acquisition during the latter half of 2018.

In accordance with D&O 35258, on February 26, 2018 the Companies filed a proposed Demand Response Adjustment Claus ("DRAC") for Hawaiian Electric and a proposed DR Performance Incentive Mechanism ("PIM") for Hawaiian Electric and Maui Electric. Pursuant to the Commission's Interim Decision and Order No. 35631 in Docket No. 2017-0150 filed on August 9, 2018 approving Maui Electric's interim rate increase, the DRAC tariff was submitted for Maui Electric on September 18, 2018.

On August 31, 2018, the Company submitted in Docket No. 2007-0341 the not-to-exceed "Total Variable Costs" of the revised DR Portfolio for recovery through the DSM surcharge until such costs are approved and reflected in the Companies' respective base rates. On September 24, 2018, the Commission issued Order 35715 directing the Companies to file an amended letter request regarding recovery of the DR Portfolio's variable costs to the costs only related to "negotiating the delivery of up to 21MW of the targeted grid services". In accordance with Order 35715, on October 4, 2018 the Companies filed an Amended Letter requesting approval to recover the revised DR Portfolio variable costs, i.e., only the costs related to "negotiating the delivery of up to 21MW of the targeted grid services" through the DSM Surcharge. On November 13, 2018, the Commission issued Order No. 35876 in which it declined to pre-authorize an unknown or maximum level of estimated costs but stated that it intends to review and rely upon the finalized GSPAs that have been negotiated with aggregators.

On February 27, 2019, the Commission issued Order 36187 in Docket No. 2017-0352 providing guidance to issue a Grid Service Request for Proposal ("RFP") concurrent to the Phase 2 RFP for Dispatchable and Renewable Generation.

On March 18, 2019 in Docket No. 2007-0341, the Companies filed a request for Commission approval of the GSPA contract with Open Access Technology International Inc. ("OATI"), and its related DR Portfolio Variable Costs to be recovered through the DSM Surcharge.

On August 5, 2019, the Commission issued Order No. 36453 in Docket No. 2015-0412 approving the DRAC. On August 22, 2019, the Companies requested that the filing date of the first DRAC be delayed in order to align with a scheduled quarterly filing. On September 3, 2019, the Commission issued Order No. 36499 approving the new filing date for the DRAC. Subsequently the Companies filed their first DRAC on October 25, 2019 under the new investigative Docket No. 2019-0323.

On August 9, 2019, the Commission issued Order No. 36467 in Docket No. 2007-0341, approving the GSPA contract with OATI ("GSPA1"), and its related DR Portfolio Variable Costs to be recovered through the DSM Surcharge. Order No. 36467 in Docket No. 2007-0341 approved OATI as the aggregator for the first round of GSPA contracts ("GSPA1 Aggregators").

On August 19, 2019, the Commission issued Order No. 36476 closing the DER Docket No. 2014-0192 and on September 3, 2019 the Commission issued Order No. 36499 closing the Demand Response Docket No. 2015-0412. Subsequently on September 24, 2019, the Commission issued Order No. 36538 which opened the Investigative docket for Distributed Energy Resources Docket No. 2019-0323.

In accordance with Order 36474 under Docket No. 2017-0352, the Companies issued RFP No. 103119-02 Grid Services from Customer-sited Distributed Energy Resources. The Companies made their selection on January 9, 2020 and initiate contract negotiation with multiple aggregator vendors.

On April 9, 2020 the Commission issued Order No. 37066 establishing three tracks within the docket, the DER Program Track, Advanced Rate Design ("ARD") Track, and Technical Track. The Commission identified the following objectives for the DER Program Track: (1) Design and implement long-term DER programs, (2) Develop a transition plan for interim DER programs. Order 37066 also identifies the Commission's strategic outcomes for this track: (1) Simple options for long-term DER tariffs, including a standard DER tariff and an advanced grid services tariff; (2) Clear and fair Transition Plan for customers in CSS, CGS, CGS+ and Smart Export to migrate to long-term tariffs, (3) Addressing NEM customers. These strategic outcomes must take into consideration the existing demand response (i.e. grid service) programs and existing or future grid service procurements that will inform the advanced grid service tariff and DER transition plans.

On July 9, 2020, under Docket No. 2007-0341 DSM Adjustment, the Companies requested approval for cost recovery for the executed GSPA contracts negotiated in RFP No. 103119-02 ("GSPA2"). OATI and Swell executed GSPA2 contracts ("GSPA2 Aggregators").

II. Request for Modification

The Companies request the following modifications in this report:

1. Request to discontinue the quarterly expense report

Hawaiian Electric requests Commission approval to discontinue the quarterly expense reporting for the Commercial and Industrial Direct Load Control ("CIDLC") program in favor of annual reporting.

2. Request to Transition EnergyScout Program Participants Using DRAC

Hawaiian Electric requests to allocate up to $750,000 in base rate variable expense in 2021 that would otherwise be reconciled and returned to Hawaiian Electric Commercial and Industrial ("C&I") customers to support the transition of existing EnergyScout program (i.e., RDLC and CIDLC) participants to new programs that offer grid services aligned to the IGP and DER Program Track.

3. Request to Use Hawaiian Electric C&I incentive budget that would be reconciled under the DRAC[2] to Transition Existing Commercial and Residential EnergyScout Program Participants.

Pending Commission approval of request #2, the Companies request to use up to $750,000 collected for C&I incentives to support the transition of existing residential and commercial EnergyScout program participants to new programs that offer grid services aligned to the IGP and DER Program Track.

The explanation and justification for these modification requests are discussed further in sections III.A.1 and III.D.3 respectively.

III. Summary of PY2021 CER Operations

The Commission has set forth directives for Customer Energy Resources ("CER") Operations cost recovery, and its preference for CER Operations costs to be reflected in base rates, rather than collected through a separate surcharge.[3] Aligned with this approach, for the program year 2021 ("PY2021"), Hawaiian Electric has included $4.8 million in base rates to manage the existing programs and Maui Electric has included $408,000 in base rates for its existing DR program. Of the proposed DR budget, $3.74 million and $384,000 for Hawaiian Electric and Maui Electric respectively will be managed to the DRAC and filed and reconciled quarterly.[4] Remaining budget request not included in base rate will continue to seek surcharge recovery until the next rate case as presented in Exhibit A.

Since late 2019, the Companies' selected Evaluation Measurement & Verification ("EM&V") consultant, The Cadmus Group Inc. ("Cadmus"), has worked on the Planning and Execution stage of their impact analysis of GSPA1 Aggregator with OATI. Cadmus provided an initial report to the Companies, attached as Exhibit B. COVID-19 has greatly affected the enrollment of new customers, so the impact studies that required a large sample of data are delayed until at least 800 customers are enrolled. The impact studies provided input into the Companies' settlement algorithm, forecast performance, and aggregator performance. In the meantime, Cadmus has interviewed OATI and its subcontractor Shifted to better understand their enrollment, enablement, and integration hurdles and successes.

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[2] See Docket No. 2015-0412, Order No. 36453 filed August 5, 2019 at 11.
[3] See Docket No. 2007-0341, Order No. 33027 filed July 28, 2015, at 57-59.
[4] See Docket No. 2015-0412, Order No. 36453 filed August 5, 2019 approving the DRAC.

In 2021, the Companies plan to take steps to begin the transition of customers from the existing EnergyScout programs to new programmatic solutions, while focusing on upgrading and maintaining the Demand Response Management System ("DRMS"). Pending Commission approval, CER Operations will begin implementation of GSPA2 Aggregators.

A. Summary of CER Operations Programs

1. Summary of PY2021 Hawaiian Electric Budget

The Companies request certain program modifications for PY2021 in order to continue maintenance of the existing DR programs and implementation of the DR Portfolio. Specifically, Hawaiian Electric requests Commission approval to discontinue the quarterly expense reporting for the CIDLC program in favor of annual reporting[5] and use of the DRAC to implement the transition proposal for the EnergyScout programs as discussed in Section D.3.

Table III-1 below provides a summary of the PY2021 Hawaiian Electric Budget with a high-level breakdown of the incremental and base costs for the existing CER Operations programs (see the attached Exhibit A for additional details). The existing CER Operations program budgets are presented for informational purposes only, as they are now included in base rates. The DR Portfolio cost shown below is the sum of the costs for GSPA aggregators (inclusive of GSPAs approved and pending Commission approval) to deliver grid services. Approved GSPAs will provide multiple grid services, the Companies will only submit summed DR Portfolio costs to avoid any procurement advantage for future potential aggregators.

Table III-1
Summary of PY2021 Hawaiian Electric Budget ($)

	Incremental	Base	Total
RDLC Program	$0	$1,858,000	$1,858,000
CIDLC Program	$0	$2,494,000	$2,494,000
Fast DR (Hawaiian Electric)	$0	$440,000	$440,000
DR Portfolio	$4,431,584	$0	$4,431,584
Total:	$4,431,584	$4,792,000	$9,223,584

[5] Reporting for Residential Direct Load Control ("RDLC") program was discontinued via letter request filed on January 10, 2014 in Docket No. 2007-0341. Currently the CIDLC program is the only program reported quarterly, while the RDLC and Fast DR program expenses are reported on an annual basis. The intent of this request is to align the reporting of the CIDLC program with the RDLC and Fast DR programs. Hawaiian Electric also notes that going forward the reporting is even further simplified since no incremental costs are being requested for PY2021.

2. Summary of PY2021 Maui Electric Budget

Table III-2 below provides a summary of the PY2021 Maui Electric Budget with a high-level breakdown of the incremental and base costs for the existing CER Operations (see the attached Exhibit A for additional details). The existing CER Operations budgets are presented for informational purposes only, as they are now included in base rates. The DR Portfolio cost shown below is the sum of the costs for GSPA aggregators (inclusive of GSPAs approved and pending Commission approval) to deliver grid services. Approved GSPAs will provide multiple grid services, the Companies will only submit summed DR Portfolio costs to avoid any procurement advantage for future potential aggregators.

Table III-2
Summary of Total PY2021 Maui Electric Budget ($)

	Incremental	Base	Total
Fast DR (Maui Electric)	$0	$408,000	$408,000
DR Portfolio	$1,513,425	$0	$1,513,425
Total:	$1,513,425	$408,000	$1,921,425

3. Summary of PY2021 Hawai'i Electric Light Budget

Table III-3 below provides a summary of the PY2021 Hawai'i Electric Light Budget with a high-level breakdown of the incremental and base costs. The GSPA pending Commission approval will provide multiple grid services, the Companies will only submit summed DR Portfolio costs to avoid any procurement advantage for future potential aggregators.

Table III-3
Summary of Total PY2021 Hawai'i Electric Light Budget ($)

	Incremental	Base	Total
DR Portfolio	$309,288	$0	$309,288
Total:	$309,288	$0	$309,288

4. Summary of PY2021 Load Impact

The forecasted PY2021 EnergyScout and Fast DR Program load impacts are shown below in Table III-4 below. The EnergyScout programs will target a lower maintenance level as there is an attrition of customers from respective programs. The Fast DR Program for Hawaiian Electric will target to maintain the same level as of the end of 2015.[6] Final enabled load for the Maui Fast DR Program is 4.9 MW. Ongoing

[6] Order No. 31558 filed in Docket No. 2012-0079 on October 21, 2013, approved the RDLC program to maintain its impact level to end of 2012 by replacing customer attrition. Order No. 31559 filed in Docket No. 2012-0079 on October 21, 2013, approved the CIDLC program to maintain its impact level to end of 2012 by replacing customer attrition.

communications with customers have identified potential future battery sites. As customer projects are built, the Company may be able to offer enrollment to capture the remaining 100 kW as well as replace any lost or underperforming sites. Customer projects have been delayed due to COVID-19; however, the Fast DR team remains engaged with these projects in order to be aware of opportunities, such as batteries.

Table III-4
Summary of PY2021 EnergyScout and Fast DR Program Load Impacts

Program	Load Impact at Customer Level (MW)
RDLC[1]	13.8
CIDLC[1]	11.7
Fast DR (Hawaiian Electric)[2]	7.0
Fast DR (Maui Electric)[2]	4.9
Total:	37.4

Notes: (1) Impacts were derived using assumptions and methodologies presented in the "2011 EnergyScout Impact Evaluation Report" filed on March 31, 2011 in Docket No. 2007-0341 and is the impact as of October 2019; (2) Fast DR customer level cumulative load impact is the total of the enabled customers.

The forecasted PY2021 DR Portfolio load impacts are shown in Table III-5 below. Enablement under the approved GSPA began in March 2020. Assumptions for load impacts include existing GSPA1 and pending GSPA2 contract capability. Due to delays caused by COVID-19, aggregators will likely be extending enablement beyond the enablement period specified in their GSPA. At this time, all aggregators are aspiring to acquire entire contract capabilities at their prescribed rate; however, they have raised concerns about continued limitations relating to COVID-19.

Table III-5
Summary of PY2021 DR Portfolio Load Impacts

Grid Services	Load Impact at Customer Level (MW)
Fast Frequency Response (Hawaiian Electric)	19.6
Capacity Load Build (Hawaiian Electric)	6.6
Capacity Load Reduction (Hawaiian Electric)	16.7
Fast Frequency Response (Maui Electric)	3.6
Capacity Load Build (Maui Electric)	1.5
Capacity Load Reduction (Maui Electric)	5.0
Fast Frequency Response (Hawai'i Electric Light)	2.2
Capacity Load Build (Hawai'i Electric Light)	1.8
Capacity Load Reduction (Hawai'i Electric Light)	1.2
Total:	58.2

B. PY2021 DR Milestones

1. Implementation DR Portfolio (MW Target) and New Aggregators

In 2021, the Companies' primary milestone is to achieve the implementation of 58.2 MW as described in Table III-5. Key to achieving the DR Portfolio MW targets specified in Table III-5, will be the on-boarding and operationalizing of the bids contracted with OATI and Swell selected from the recent Request for Proposal (RFP No. 103119-02).

2. EnergyScout Program Transition Plan

As discussed in more detail below in Section D.3, the Companies are proposing a plan to transition EnergyScout program participants to opportunities that support the delivery of a variety of Grid Services.

C. DR Portfolio

1. Grid Service Implementation with GSPA Aggregators

i. PY2021 Key Activities

The DR Portfolio will be performing the implementation and on-boarding process with aggregators as soon as the contracts are approved by the Commission.[7] Key activities in PY2021 include the following:

- Support ongoing Aggregator operations and delivery of Grid Services.

[7] See Docket No. Docket No. 2007-0341 DSM Adjustment filed July 9, 2020, requesting approval for cost recovery for the executed GSPA contracts negotiated in RFP No. 103119-02 ("GSPA2").

- Implement and initiate operations of grid services delivered by GSPA2 Aggregators.
- Complete negotiation of the final GSPA contract awarded under RFP No. 103119-02 and file executed GSPA with the Commission by March 2021.

a. Aggregator Operations

The COVID-19 pandemic has significantly impacted OATI's ability to approach customers for enrollment and gain access to their premises to install the necessary equipment. OATI has modified its marketing efforts to a hyper-local focus and have been successful in enrolling some customers, but have not been able to achieve their GSPA1 Contract Capability.[8] OATI has requested invocation of Force Majeure under the contract to allow additional flexibility in the timing of the acquisition of participants. For PY2021, the Companies will continue to monitor the situation and provide any support required to assist OATI with meeting its Contract Capability for GSPA1.[9]

b. GSPA Aggregator Integration

OATI started its integration effort with the Companies in the fourth quarter of 2019 and started implementing and delivering aggregated grid services in early 2020. Key activities in PY2021 include the following:

- Fully integrate Swell with the DRMS[10] to allow Hawaiian Electric's System Operations to dispatch DR resources as Grid Services from a single interface.
- As OATI is already integrated with DRMS, no integration steps are necessary to enable the incremental increase in Grid Services.

As discussed above, COVID-19 has impacted OATI's ability to acquire participants and to gain access to participants' premises to install equipment. Depending on the status of the pandemic, the Companies expect that Swell may encounter the same barriers. To date, no GSPA2 Aggregators have requested a change in their Contract Capability under the GSPA or requested invocation of Force Majeure.

c. GSPA2 Aggregator Negotiation

Three proposals were selected in RFP No. 103119-02 and two counterparties have executed the GSPA and are awaiting approval by the Commission.[11] Negotiations with the final bidder are ongoing and the Companies hope to file an executed GSPA with the Commission by March 2021.

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[8] See Docket No. 2007-0341, Order No. 36467 filed August 9, 2019.
[9] At *id.*
[10] See Docket No. 2015-0411, Decision and Order No. 34884 filed on October 18, 2017.
[11] See Docket No. 2007-0341 DSM Adjustment filed July 9, 2020, requesting approval for cost recovery for the executed GSPA contracts negotiated in RFP No. 103119-02 ("GSPA2".

ii. PY2021 Program Budget and Load Impacts

Table III-6 and Table III-7 below provide the projected DR Portfolio budgets for Hawaiian Electric, Maui Electric, and Hawai'i Electric Light, respectively.[12] Table III-3 shows the forecasted load amount that will be delivered by the aggregators.

Table III-6
DR Portfolio
2021 Budget ($)

	Incremental	Base	Total
DR Portfolio (Hawaiian Electric)	$4,431,584	$0	$4,431,584
DR Portfolio (Maui Electric)	$1,513,425	$0	$1,513,425
DR Portfolio (Hawai'i Electric Light)	$309,288	$0	$309,288
Total:	$6,254,297	$0	$6,254,297

Table III-7
DR Portfolio
2021 Program Impact (MW)

	Program	Load Impact at Customer Level (MW)	Load Impact By Island (MW)
DR Portfolio (Hawaiian Electric)	Fast Frequency Response	19.6	42.9
	Capacity Load Build	6.6	
	Capacity Load Reduction	16.7	
DR Portfolio (Maui Electric)	Fast Frequency Response	3.6	10.1
	Capacity Load Build	1.5	
	Capacity Load Reduction	5.0	
DR Portfolio (Hawai'i Electric Light)	Fast Frequency Response	2.2	5.2
	Capacity Load Build	1.8	
	Capacity Load Reduction	1.2	
	Total:	58.2	58.2

D. Existing CER Operations

1. Residential Direct Load Control Program

Hawaiian Electric will continue the existing CER Operations to maintain customer participation and MW impacts for RDLC and continue the Companies' experience with

[12] See Docket No. 2007-0341, Decision and Order No. 36467 filed on August 9, 2019, approving the GSPA contract with OATI, and its related DR Portfolio Variable Costs to be recovered through the DSM Surcharge.

DR. In Order No. 32660 filed on February 2, 2015, the Commission clarified that the existing programs may continue at current maintenance levels without modification until a further order is issued.[13]

iii. PY2021 Key Activities

In 2021, Hawaiian Electric will engage in the following key activities in support of the RDLC Program:

- Maintain existing RDLC Program infrastructure to continue providing Fast Frequency Response ("FFR") and allow Hawaiian Electric's System Operations to dispatch DR resources during peak load and economically favorable conditions. Third-party program implementers will continue to provide program maintenance by supporting customers and field installations.
- Collaborate with Hawai'i Energy and community partners to: identify and jointly develop market opportunities for DR and Energy Efficiency programs; coordinate outreach to potential customers; and coordinate funding for customer enablement and participation.
- If approved and in accordance with Section D.3 below, the Company will work with RDLC Program participants to inform them of changes and prepare for potential transition impacts.

iv. PY2021 Program Budget and Demand Savings Impacts

For the PY2021, as shown in Table III-7 below, Hawaiian Electric will include all RDLC program costs in base rates in accordance with the Hawaiian Electric 2017 test year rate case. As of 2021, the impact for the RDLC Program is 13.8 MW (customer level). See Exhibit A for additional details.

Table III-7
Hawaiian Electric RDLC Program
2021 Program Budget ($)

RDLC Program	2021 Program Budget
Incremental	$0
Base	$1,858,000
Total:	$1,858,000

2. Commercial and Industrial Direct Load Control Program

The Companies are requesting approval to discontinue the quarterly expense reporting for the CIDLC program in favor of annual reporting. This will alleviate duplicative reporting requirements as the Companies reports expenses annually in the A&S Report.

[13] Docket No. 2007-0/341, Order No. 32660, filed on February 2, 2015, at 12.

i. PY2021 Key Activities

In 2021, Hawaiian Electric will engage in the following key activities in support of the CIDLC program:

- Maintain existing CIDLC program infrastructure to continue providing FFR and allow Hawaiian Electric's System Operations to dispatch DR resources during capacity shortfall conditions. Third-party program implementers will continue to provide program maintenance by supporting customers' field installations.
- If approved and in accordance with Section D.3 below, the Company will work with CIDLC program participants to inform them of changes and prepare for potential transition impacts.

ii. PY2021 Program Budget and Demand Savings Impacts

As shown below in Table III-8 below, Hawaiian Electric will include all CIDLC program costs in base rates in accordance with the Hawaiian Electric 2017 test year rate case. As of 2020, the target impact for the CIDLC program is 11.7 MW (customer level). See Exhibit A for additional details.

Table III-8
Hawaiian Electric CIDLC Program
2021 Program Budget ($)

CIDLC Program	Existing Year 2021 Budget
Incremental	$0
Base	$2,494,000
Total:	$2,494,000

3. Transition Proposal for Existing EnergyScout Programs

The Company is pursuing a programmatic solution to transition the existing EnergyScout program participants to a new program(s) that offers grid service delivery. The Company also intends to align the transition model for replacing the existing EnergyScout resources with programmatic solutions that will be proposed in the Program Track of Order No. 37066 under Docket No. 2019-0323.

The Company would like to transition existing EnergyScout program participants into opportunities where they can participate at a higher level and potentially receive a correspondingly increased incentive or bill credit. The current EnergyScout program parameters and technology limit the participants' resource capability to fully deliver the grid services. Specifically, existing program constraints, such as lengthy pre-notification periods, and the technology's one-way communications limit participants' ability to deliver multiple grid services. A final concern for the Company is that the existing EnergyScout program devices are over ten years old and are estimated to be either

at or near the end of their useful lives. While no large-scale increase in device failure has occurred, there is concern that since devices were installed at around the same time, they would all likely fail in a similar timeframe.

Furthermore, only one aggregator offered a relatively small amount of load resources to fulfill grid services and the Company would like to provide opportunities to customers that do not rely solely on photovoltaic or energy storage to help offset their electricity costs. Generally, to date, aggregators have been more focused on battery storage control and not necessarily conventional DR solutions.

The Company is proposing to follow the basic steps below to transition EnergyScout program participants to new technologies and programs. The Company's intended path forward in 2021 includes:

1. RFP solicitation to transition EnergyScout program participants into the new programs with new technology.
2. Submit a request to the Commission for approval of new programs as applicable under Docket No. 2019-0323. This M&E has already requested the necessary cost recovery to implement the transition.
3. Pending Commission approval of variable expense reallocation and proposed program, begin transition to new programs at the capped value of $750,000. Until an acceleration of transition is required, Company proposes to proceed with the transition without increasing the customer's bill.

Upon Commission approval of the Company's requests regarding Hawaiian Electric's DRAC, the Company will submit a more detailed plan within 45 days specifying the transition of existing EnergyScout program participants that aligns with the programmatic solution(s) being proposed in Docket 2019-0323.

To jump start the transition, the Company issued a market survey in October 2020 to assess technology and services available to address both demand and supply options to fulfill grid services. The Company received 23 full responses and additional partial responses. The responses to the market survey will be used to inform an RFP solicitation to transition EnergyScout program participants into the new programs with new technology. The market survey will also provide the necessary information to develop the roadmap for 2021 programmatic options under Docket No. 2019-0323.

The Company's goal for the transition of EnergyScout program participants is to implement cost-effective program(s) to deliver grid services. In addition, the Company is looking to maximize customer opportunities including:

- Programs for all customer building types, including residential rental and condos;
- Options to provide multiple end device participation;
- Participation in multiple grid services; and,

- Simple and easy customer enrollment and enablement, i.e. minimal customer touch points.

The Company hopes the market survey and RFP will provide solutions that can fulfill these objectives.

The Company is requesting to use the DRAC to achieve the initial steps of the transition plan to avoid seeking additional funding from the Commission and ratepayers. Incentives paid to participants are the only variable costs currently included in base rates and reconciled in the DRAC. Pending Commission approval of the two requests, the Company will proceed each year with an annual not-to-exceed cap of $750,000 annually. Based on the transition progress and market adoption, the Company may propose adjustments to increase this budget item beyond $750,000 in future years for Commission approval.

Specifically, the Company is requesting:

1. To allocate up to $750,000 in base rate variable expense in 2021 that would otherwise be reconciled and returned to Hawaiian Electric C&I customers to support the transition of existing EnergyScout programs.

2. To use the Hawaiian Electric C&I incentive that would be reconciled under the DRAC to transition existing commercial and residential EnergyScout Program Participants.

The Company seeks these modifications to have flexibility in initiating the transition of the EnergyScout program participants. The RFP will inform up to how many customers could be transitioned each year with a cap of $750,000. The Company will continue to reconcile and file DRAC adjustments as directed in Order No. 36538.[14] The Company will also include a separate line item(s) for reporting the usage of funds for the transition of existing EnergyScout participants.

Table III-9 presents the Hawaiian Electric 2020 estimated DRAC reconciliation calculated using Approved Rate Base Budget minus the estimated 2020 spend. The estimated 2020 spend consists of year to date actuals through October, and the estimated November and December amounts of $218,000 for residential and $405,667 commercial. The 2020 Variance column represents the unspent variable costs (incentives) included in base rates.

[14] Order No. 36538, filed September 24, 2019, Ordering Paragraph 2 at 13.

Table III-9
Hawaiian Electric 2020 Estimated DRAC Reconciliation

Program	Approved Rate Base Budget	Estimated 2020 Spend	2020 Estimated Variance
Residential	$1,308,228	$1,298,876	($9,352)
Commercial	$3,280,918	$2,090,406	($1,190,512)
Total:	$4,589,146	$3,389,282	($1,199,864)

As ordered in Order No. 36538, the company reports the DRAC reconciliation on a quarterly basis. The most recent filing for the third quarter 2020 was filed on October 26, 2020.[15] For Hawaiian Electric, the filing reported residential spend of $975,746 from approved budget of $976,200 and commercial spend of $1,522,376 from approved budget of $2,448,221 (all amounts are through third quarter 2020). The total variance through third quarter was $926,299.

Current EnergyScout program costs are recovered from all ratepayers in base rates. EnergyScout program benefits are not allocated to any specific customer class but are realized by all customers through reduced fuel costs, operational efficiencies and reduced operations and maintenance costs. For example, DR programs utilizing commercial customer resources doesn't benefit just the commercial customer class but rather all customer classes. Rather than returning unspent variable commercial incentives to commercial customers, the Company is seeking the opportunity to use unspent amounts to initiate the transition path of the EnergyScout program participants for the benefit of all customers.

4. Fast DR Program

i. PY2021 Key Activities

There are no proposed modifications to the existing Hawaiian Electric Fast DR Program planned for 2021.

In 2021, Hawaiian Electric and Maui Electric will engage in the following key activities in support of the Fast DR Program:

- Maintain existing Fast DR Program infrastructure to allow Hawaiian Electric and Maui Electric System Operation to dispatch DR resources during peak load and economically favorable conditions. Third-party program implementers will continue to provide program maintenance by assisting in responding to service calls and supporting field installations.
- Perform replacement analysis to maintain the load for Fast DR. Several participants unenrolled in 2020, and the Companies will be seeking to enroll replacement sites in 2021.

[15] Docket No. 2019-0323, Order No. 36538, filed on October 26, 2020.

ii. PY2021 Program Budget and Demand Savings Impacts

Table III-10 and Table III-11 below provide the Fast DR Program budgets for Hawaiian Electric and Maui Electric, respectively. The targeted 2021 impact for the Fast DR Program is 7.0 MW (customer level) for Hawaiian Electric and 4.9 MW (customer level) for Maui Electric. See Exhibit A for additional details.

Table III-10
Hawaiian Electric Fast DR Program
2021 Program Budget ($)

Fast DR Program (Hawaiian Electric)	2021 Program Budget
Incremental	$0
Base	$440,000
Total:	$440,000

Table III-11
Maui Electric Fast DR Program
2021 Program Budget ($)

Fast DR Program (Maui Electric)	2021 Program Budget
Incremental	$0
Base	$408,000
Total:	$408,000

E. CER Operations Technology

Implementation of high availability infrastructure for the DRMS will be completed during summer of 2021. High availability feature provides additional redundancy and resiliency that will be built into the DRMS infrastructure by adding servers and redundant applications and processes to minimize system downtime. Integration with the Meter Data Management System for meter interval data will also be performed in PY2021.

Ongoing maintenance activities will continue and include implementing security patches, application updates from the DRMS vendor, and additional reporting and tracking as needed for monitoring performance of programs and aggregators. Control technology for existing EnergyScout programs will also continue to be maintained, including implementing security patches and application updates from the Yukon vendor.

The Companies plan to fully transition to IEEE 1547-2018 for all new DERs on January 1, 2022. The IEEE 1547-2018 standard requires all DER to provide a communication interface that may allow for point-to-point telemetry and complex operational controls using a standard communication protocol. The Companies will assess

the options and costs of integrating the new IEEE 1547-2018 communication protocols into the DRMS in PY2021, as well as extending the existing OpenADR implementation to handle more complex controls for direct-to-device point-to-point communications. Implementation of these initiatives in the DRMS would not be able to start until September 2021, after the implementation of high availability infrastructure, because the necessary resources are committed to the high availability project.

F. CER Operations Initiatives

1. Self-Aggregator Pilot - Update

The Companies continue to investigate alternative methods to operationalize customer energy resources, such as the self-aggregator methodology where a larger commercial/industrial customer aggregates their own resources to deliver a grid service. The Companies have completed contract negotiations with a large customer to pursue deliverance of grid services via a self-aggregator model. The Statement of Work provides for piloting customer self-aggregation of Capacity Reduction and Capacity Build Grid Services in accordance with the definitions in the GSPA.

i. PY2021 Key Activities

The key activity for PY2021 is to execute the self-aggregator pilot project.

2. Integrated Grid Planning Non-Wires Alternative RFP - Update

The Soft Launch RFP issued on November 8, 2019, was intended to be an opportunity to test IGP concepts as part of a non-wires alternatives ("NWA") demonstration to focus on successful implementation of a distribution service such that lessons learned would be incorporated into the full IGP process, especially regarding NWA sourcing and evaluation. Hawaiian Electric, in consultation with the Independent Observer, decided not to move forward with the IGP Soft Launch RFP bidders due to an insufficient response to the RFP performance and operations requirements (MW and duration) needed to defer the planned investment. Companies will continue to investigate NWA opportunities utilizing customer energy resources in 2021.

G. Evaluation, Measurement & Verification (EM&V)

On February 10, 2017, in the Revised DR Portfolio filing, the Companies requested a three-year EM&V cycle, and in D&O No. 35238,[16] the Commission found that "the proposed reporting structure is reasonable and provides sufficient transparency and timely updates to inform the relative success of the DR program." In the 2019 A&S report, Cadmus (the Companies' EM&V consultant) provided a memo depicting how benefits will be realized with the use of aggregator performance data.

In 2020, aggregators started recruitment to deliver grid services on Maui and O'ahu, but shortly after their start, COVID-19 impacted their recruitment plans. With

[16] See Companies' Reply Statement of Position, Docket No. 2015-0412, filed May 5, 2017.

limited customers to evaluate, Cadmus was not able to complete its data collection and analysis. However, Cadmus was able to evaluate the Companies' and aggregator's processes including areas of DRMS integration, forecasting grid services capability and settlements, marketing and enrollment of HECO customers, customer satisfaction, and evaluation. The initial findings noted challenges faced by the aggregator and the steps taken to resolve these. Examples include difficulty enrolling targeted customers which was resolved by adjusting marketing efforts, forecast challenges related to granularity of data which was improved by updating firmware, settlement discrepancies that are currently being evaluated by the aggregator and will be verified by Cadmus once adjusted, and lower than expected enrollment numbers caused by marketing barriers and COVID which is being mitigated with new marketing strategies.

A memo describing Cadmus's findings to date is provided in Exhibit B.

i. PY2021 Key Activities

The 2021 evaluation tasks have been modified as a result of COVID-19 as follows:

- Estimate the DR impacts for FFR, Capacity Build, and Capacity Reduction by end use on O'ahu for water heaters only.
- Begin calculating and verifying DR impacts for residential solar plus battery and commercial customers.
- Collect data loggers deployed on residential water heaters at the conclusion of the water heater impact analysis and reconfigure for deployment with batteries/PV systems.
- Evaluate settlement calculation methods to determine if payments are appropriate and compensation is accurate in accordance with the GSPA.
- Evaluate forecasts submitted by aggregator for accuracy.

IV. Conclusion

In conclusion, the Companies respectfully submit this M&E Report which details the required activities and budget to maintain the existing CER Operations, expands the implementation of the DR Portfolio in 2021, and plans for pursuing a programmatic solution to transition the existing EnergyScout participants to a new program(s) that offers multiple grid service delivery.

The Companies request Commission approval of budget and certain program modifications for PY2021. Specifically, Hawaiian Electric requests Commission approval to: (1) Discontinue the quarterly expense reporting for the CIDLC; (2) Allocate up to $750,000 in base rate variable expense in 2021 that would otherwise be reconciled and returned to Hawaiian Electric C&I customers to support the transition of existing EnergyScout programs, and; (3) Use the Hawaiian Electric C&I incentive that would be reconciled under the DRAC to transition existing commercial and residential EnergyScout Program Participants.

EXHIBIT A
Existing Legacy DR Programs
2021 Budget ($)

	RDLC Program[2]	CIDLC Program[2]	Fast DR (Hawaiian Electric)[2]	Fast DR (Maui Electric)[2]
Incremental[1]				
Incentives	0	0	0	0
Materials				
Equipment Purchases	0	0	0	0
Outside Services				
General	0	0	0	0
Installation Allowance	0	0	0	0
Advertising and Marketing	0	0	0	0
Evaluation	0	0	0	0
Miscellaneous	0	0	0	0
Subtotal	0	0	0	0
Other				
Travel	0	0	0	0
Amortization	0	0	0	0
Software-Maintenance	0	0	0	0
Miscellaneous	0	0	0	0
Subtotal	0	0	0	0
Base[2]				
Incentives	1,308,000	2,194,000	240,000	384,000
Materials				
Equipment Purchases	0	0	0	0
Transportation				
Vehicles	0	0	0	0
Outside Services				
General	550,000	300,000	200,000	24,000
Installation Allowance	0	0	0	0
Advertising and Marketing	0	0	0	0
Evaluation	0	0	0	0
Miscellaneous	0	0	0	0
Subtotal	550,000	300,000	200,000	24,000
Other				
Travel	0	0	0	0
Amortization	0	0	0	0
Software-Maintenance	0	0	0	0
Miscellaneous	0	0	0	0
Subtotal	0	0	0	0
Total Program Cost	**1,858,000**	**2,494,000**	**440,000**	**408,000**
Total Incremental Cost	0	0	0	0
Total Base Cost	1,858,000	2,494,000	440,000	408,000
Estimated MW Impact (End of year):	13.8	11.7	7.0	4.9

NOTES:
[1] Incremental expenses are recovered through the IRP Cost Recovery Adjustment.
[2] Base expenses are recovered through base rates and not the IRP Cost Recovery Adjustment.

EXHIBIT A
DR Portfolio & Implementation Phase
2021 Budget ($)

	DR Portfolio (Hawaiian Electric)	DR Portfolio (Maui Electric)	DR Portfolio (Hawaii Island)	DRMS Amortization & M&S[3]	DRMS[2]
Incremental[1]					
Incentives	1,645,947	445,758	245,908	0	0
Materials					
Equipment Purchases	0	0	0	0	0
Outside Services					
General	2,785,636	1,067,667	63,380	0	0
Installation Allowance	0	0	0	0	0
Advertising and Marketing	0	0	0	0	0
Evaluation	0	0	0	0	0
Miscellaneous	0	0	0	0	0
Subtotal	2,785,636	1,067,667	63,380	0	0
Other					
Travel	0	0	0	0	0
Amortization	0	0	0	319,563	0
Software-Maintenance	0	0	0	382,719	0
Miscellaneous	0	0	0	0	0
Subtotal	0	0	0	702,282	0
Base[2]					
Incentives	0	0	0	0	0
Materials					
Equipment Purchases	0	0	0	0	0
Transportation					
Vehicles	0	0	0	0	0
Outside Services					
General	0	0	0	0	0
Installation Allowance	0	0	0	0	0
Advertising and Marketing	0	0	0	0	0
Evaluation	0	0	0	0	0
Miscellaneous	0	0	0	0	0
Subtotal	0	0	0	0	0
Other					
Travel	0	0	0	0	0
Amortization	0	0	0	0	0
Maintenance and Support	0	0	0	0	160,000
Miscellaneous	0	0	0	0	0
Subtotal	0	0		0	160,000
Total Program Cost	**4,431,584**	**1,513,425**	**309,288**	**702,282**	**160,000**
Total Incremental Cost	4,431,584	1,513,425	309,288	702,282	0
Total Base Cost	0	0	0	0	160,000
Estimated MW Impact (End of year):	42.9	10.1	5.2		

NOTES:
[1] Incremental expenses are recovered through the IRP Cost Recovery Adjustment.
[2] Base expenses are recovered through base rates and not the IRP Cost Recovery Adjustment.
[3] The above amounts are reflective of filings under Docket 2015-0411. These incremental expenses will be recovered through the Renewable Energy Infrastructure Cost Recovery Provision.

CADMUS

Memorandum

To: Nohea Hirahara; Hawaiian Electric Company

From: Jim Stewart, PhD, Zachary Horvath, and Alex Chamberlain; Cadmus

Subject: HECO Demand Response Grid Service Purchase Agreement Evaluation

Date: November 20, 2020

Introduction

In March 2019, HECO reached a grid services purchase agreement (GSPA) with Open Access Technology International, Inc. (OATI). The GSPA aggregator provides fast frequency response (FFR), capacity building, and capacity reduction grid services. The agreement called for the aggregator to provide about 11 MW of FFR, 1 MW of capacity building, and 10 MW of capacity reduction in Oahu and Maui. The GSPA spans a five-year term beginning on the date of system integration with HECO. The grid services will be enabled over the first two years of the GSPA term and continue through the remaining three years. Shifted Energy is one of OATI's subcontractors and is providing grid services to HECO through control of residential electric water heaters. The aggregator began the first demand response grid services events in March 2020, and by October 2020 had enrolled more than 700 Oahu residential customers in water heater demand response through the GSPA. The aggregator expects to begin enrolling Maui residential customers with grid-enabled water heaters, Oahu residential customers with PV/battery storage systems, and Oahu and Maui commercial customers with battery storage systems in late 2020 or 2021.

As the GSPA evaluator, the Cadmus/Demand Side Analytics team (henceforth, Cadmus) is responsible for assessing the implementation of the GSPA, with the objective of documenting implementation successes and shortcomings as well as lessons learned for future grid services implementations. This memo provides Cadmus' assessment of the GSPA implementation progress in the areas of distributed energy resources management system (DERMS) integration, forecasting grid services capability and settlements, marketing and enrollment of HECO customers, customer satisfaction, and evaluation.

To collect information for this assessment, Cadmus interviewed project managers and technical staff from OATI and Shifted Energy in December 2019 and again in November 2020, and Cadmus submitted written questions to OATI and Shifted Energy. Cadmus also interviewed HECO GSPA managers in October 2020.

Summary of Key Findings

There are several important findings from this evaluation of the GSPA implementation:

- The COVID-19 pandemic interfered with and slowed the marketing to and enrollment of HECO customers in demand response through the GSPA. Early in the pandemic, OATI notified HECO, and HECO agreed, that the pandemic is an event of force majeure, outside of any party's control, that would impact the enrollment and enablement schedule. The pandemic notwithstanding, the aggregator had enrolled more than 700 Oahu residential customers in water heater demand response through October 31, 2020.

- While GSPA enrollment commitments are about three months behind schedule, the aggregator intends and expects to meet its megawatt grid services commitments under the GSPA. In addition to slowing the enrollment of residential customers in water heater demand response, the pandemic has delayed the aggregator's enrollment of residential customers in PV/battery storage system demand response and commercial customers in battery storage demand response.
- The aggregator has primarily marketed water heater demand response to low- or middle-income residential customers in multifamily buildings. There are many barriers to enrolling these customers in demand response: English may not be the customer's primary spoken language, it is difficult to contact the household decision maker, and the customer may not be interested or engaged in managing energy consumption. The aggregator overcame these barriers by forging relationships ("talking story") with multifamily building managers and by adapting the marketing to reach customers who do not have a significant online presence.
- It has been challenging to integrate OATI's Grid Services Delivery System (GSDS) with HECO's DERMS. Formal testing of this integration concluded in spring 2020 but the aggregator has continued to adjust integration when modification has been required to address integration issues that have risen during the year. While HECO's GSPA handbook provides invaluable guidance for aggregators, it is challenging to align the aggregator's delivery system with HECO's business operations, enrollment, and reporting conventions.
- Several factors have challenged the aggregator's ability to accurately forecast demand response grid services for the water heaters currently enrolled. These challenges include poor cellular coverage in some areas of Oahu, participants who turn off the water heater circuit breaker to manage energy consumption, the unavailability of demand data for newly enrolled customers, and hard-to-predict, pandemic-related changes in water heater demand. The aggregator has implemented steps, described in the *Forecasting and Settlements Challenges* section below, to address or resolve these issues.
- HECO has observed discrepancies in reported grid services capability between the monthly settlement reports submitted by OATI and OATI's forecasts in DERMS. The aggregator is aware of these discrepancies, is investigating the causes, and intends to develop a solution.
- Cadmus worked with HECO and the aggregator to implement a randomized controlled trial (RCT) for estimating the impacts from the demand response grid services. The RCT is expected to be implemented between December 2020 and March 2021, and Cadmus will analyze telemetry data from individual water heaters after the RCT concludes. A RCT is the gold standard in demand response evaluation and is expected to result in unbiased estimates of grid services impacts.
- According to the aggregator, water heater demand response participants have not been adversely affected by the demand response events. The aggregator said it has received no customer complaints about the unavailability of hot water, suggesting that the FFR and capacity reduction events have not negatively affected customer comfort.

Lessons Learned

There were several important lessons from this evaluation of the first year of GSPA implementation:

- This GSPA implementation suggests that low- and middle-income customers are willing to supply demand response grid services and that utilities and demand response aggregators can enroll such customers. Many U.S. utilities would like to increase the participation of low- and middle-income customers in demand response and load flexibility programs but often cite barriers to their enrollment.[1] The upcoming RCT impact analysis will reveal these customers' ability to supply demand response grid services.
- Enrollment in demand response by multifamily low- and middle-income customers can be increased by adapting the standard marketing approach to the specific circumstances of this traditionally hard-to-reach residential customer segment. Successful marketing strategies included establishing trust by using building managers as intermediaries, employing messages that resonate with customers, using paper marketing collateral for customers who do not have a strong online presence, and simplifying the enrollment process.
- The grid services purchase agreement does not require the aggregator to implement a randomized experiment to evaluate the grid services impacts. The aggregator and HECO are drafting an agreement to implement a RCT. Future HECO grid services purchases contracts should require that aggregators be prepared to implement RCTs for evaluating the grid services in cooperation with HECO's evaluation contractors.
- HECO's demand response aggregator handbook was a valuable reference for the aggregator. HECO and the aggregator have continued to collaboratively update the handbook as unanticipated situations arise, which should make the handbook even more useful in the future.
- The GSPA implementation revealed grid services opportunities in residential water heating that do not affect customer satisfaction. To date, capacity reduction and FFR grid services do not appear to have adversely impacted the customer experience.
- The aggregator's attempt to accelerate enrollment in water heater demand response by pre-approving and installing control devices before completing application process in multifamily buildings did not work as planned. This was primarily due to customers not completing the application because they did not have or want to find all three numbers (HECO account, meter, and contract id) required to enroll. This has led Shifted Energy, in some instances, to remove control devices, and in others, to leave control devices in place in case future tenants may want to participate. The aggregator now requires customers to enroll before installing the control devices.

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[1] The Maryland electric utilities recently completed an impact evaluation of a new time-of-use rate on demand from low- and middle-income customers. The evaluation showed that these customers reduced their summer peak loads by 8.1% in the Baltimore Gas and Electric service area, 10.7% in the Pepco service area, and 13.7% in the Dayton Power & Light service area. See: The Brattle Group. 2020. *PC44 Time of Use Pilots: Year One Evaluation*. Prepared for Maryland Joint Utilities.

Detailed Findings

This section provides detailed findings from Cadmus' assessment of the GSPA in terms of DERMS integration, forecasting grid services capability and settlements, marketing and enrollment of HECO customers, customer satisfaction, and evaluation.

Systems Integration

After the implementation contract was finalized in March 2019, the aggregator worked with HECO to integrate their systems. Integration activities included reviewing technical information, resolving technical challenges, developing scenarios for testing demand response grid services, and establishing procedures for passing data between the aggregator and HECO.

The aggregator integrated and tested the systems in three phases:

1. ***Phase One: Integration.*** Per the GSPA, the integration process consisted of establishing data connections to communicate participant status, incentive payments to participants, and enablement information as well as to integrate control functionality between HECO's DERMS and OATI's GSDS. This phase occurred in 2019.
2. ***Phase Two: Informal Testing.*** The aggregator tested interfaces to ensure that data flowed seamlessly from Shifted Energy to OATI's GSDS. This phase began in late 2019.
3. ***Phase Three: Formal Testing.*** The aggregator confirmed that the interfaces worked correctly and successfully provided data to HECO (ensuring that HECO and OATI can deliver grid services, per the GSPA). This phase concluded in spring 2020.

Although the formal testing phase has concluded and demand response grid services events occurred in 2020, the GSPA aggregator continues to refine the integration as needs change or issues are identified. For example, the GSPA aggregator noted occasional cellular communication issues with the water heaters, and therefore created redundancies in its telemetry data collection and forecasting process to generate forecasts in situations where telemetry data are missing.

There was another issue concerning the collection of telemetry data: the GSPA requires the aggregator to collect five-minute interval data for calculating and reporting settlements. However, due to the water heater controller firmware being programmed incorrectly, telemetry data were only being collected in 15-minute intervals. Cadmus first alerted HECO to this issue in June 2020, but many devices continued to record data in 15-minute intervals until October 2020. In October 2020, after Cadmus alerted HECO to the persistence of this issue, the aggregator updated its firmware to collect five-minute interval data. This update resolved the issue for most GSPA water heaters; however, some controllers in areas with poor cellular coverage did not accept the firmware update. The GSPA aggregator rewrote the update to address the water heaters in areas with poor cellular coverage. The population of about 700 water heater controllers now supplies five-minute interval consumption data except from controllers stationed in very poor cellular coverage areas or where tenants flipped the water heater breakers to manage energy consumption. The aggregator plans to unenroll about 12 water heaters in the aforementioned areas of poor cellular coverage.

Operational Forecasts and Settlements

Per the GSPA, the aggregator provides HECO with operational forecasts for each grid service at regular frequencies. Table 1 shows the attributes of each forecast that the aggregator transmits from its GSDS to HECO's DERMS.

Table 1. Operational Forecast Attributes

Attributes	Aggregator Grid Services		
	FFR	Capacity Building	Capacity Reduction
Forecast Capability	kW/kWh	kW/kWh	kW/kWh
Forecast Term (Minimum)	4 days	4 days	4 days
Data Resolution (Interval)	15 minutes	15 minutes	15 minutes
Update Timing	Hourly	1 a.m./1 p.m.	1 a.m./1 p.m.
Update Frequency	Hourly	Every 12 hours	Every 12 hours

The aggregator develops its forecasts using electrical current, voltage, and frequency data supplied directly by its controllers. The aggregator generates forecasts of demand response grid services capability for each enrolled water heater and remodels all forecasts one hour before the forecast is dispatched to DERMS. Each iteration of remodeling accounts not only for recent water heater electricity consumption, but also for patterns indicating whether the enrolled customer had vacated the home temporarily. When a customer leaves the home for vacation or other reasons, the model devalues the forecasted capacity of the unit accordingly. The aggregator uses machine learning algorithms to predict the available demand response grid services capabilities, and regularly updates the models to improve the forecast accuracy.

In addition to developing grid services forecasts, the GSPA aggregator submits a monthly settlement report (called a Monthly Invoice Report, or MIR) to HECO. The MIR is the basis for compensating the aggregator for enabling and managing grid services. Each MIR includes numerous data for settlement, including the DERMS forecasts, event performance factors, settlement factors, baseline calculations, and end-use data. The GSPA aggregator generates the MIR using industry software that can be configured to match the specific requirements of the GSPA, then reviews the MIR before sending it to HECO.

Forecasting and Settlements Challenges

The GSPA faces several challenges in developing accurate forecasts of grid services capability:

- The aggregator lacks load shape data for newly enrolled water heaters prior to their enrollment. To forecast proxy grid services capability for newly enrolled water heaters, the aggregator uses historical data from existing units of similar size and location in machine learning models that it routinely tests and re-trains. Once the newly enrolled unit accumulates up to two weeks of data, the aggregator can train its model on the unit's actual data and discard the proxy forecast.
- There were connectivity issues with some water heaters, which the aggregator resolved by rewriting its firmware code.
- The aggregator periodically observes unusual readings in its telemetry data, so the aggregator instituted validation rules to flag and correct the readings to prevent forecast inaccuracies.

- There are additional possible causes of discrepancies, including pandemic-related issues (such as stay-at-home/work-from-home orders and similar unpatterned disruptions) that confound the prediction of consumption trends, as well as customers who regularly flip their water heater's electrical breaker to manage energy consumption associated with tank standby losses.

Discrepancies between Grid Services Forecasts and Settlements

The megawatt forecasts of grid services and the reports of megawatt delivered capability in the MIRs should be consistent. However, HECO has observed discrepancies between the aggregator's monthly settlement reports and DERMS operational forecasts. The aggregator and HECO are investigating the causes and will develop solutions to resolve them. As the forecasts of grid services capability uploaded to the HECO DERMS constitute the basis for the settlements, a factor contributing to the discrepancy may be inconsistencies in version control between DERMS and GSDS.

There is a similar but unrelated issue concerning discrepancies between water heater enrollments in the Participant Incentive Capability (PIC) reports and the MIRs. The PIC reports list the individual water heaters enrolled through the GSPA and show the monthly incentive and capability per device. These enrollments should match those in the MIRs but have not always aligned. A cause of the discrepancy is likely related either to participants who unenroll after moving out of their home or to customers who the aggregator enrolls but HECO rejects as ineligible and must unenroll. According to the GSPA, enrolled customers are supposed to notify the aggregator if they move out of their home. The aggregator is then supposed to remove these customers from the system. This process has not worked as intended (as customers who move out have not always notified the aggregator).

These discrepancies, which the aggregator is working to resolve, highlight a significant challenge with integrating the aggregator's GSDS and HECO's DERMS. While the technical integration of communication between the two systems is usually straightforward, the aggregator must also coordinate with HECO's business practices. To help with this coordination, HECO developed an aggregator handbook, which both HECO and the aggregator agree has proved valuable for aligning their systems and coordinating.

Marketing and Customer Enrollment

As of the end of October 2020, the GSPA aggregator had enrolled and installed control devices on approximately 700 water heaters in Oahu. Almost all enrolled water heaters were in multifamily buildings for low- and middle-income households. Only two water heaters are enrolled in Maui.

At the beginning of 2020, the GSPA aggregator said it expected to enroll and activate 1,350 water heaters in Oahu and Maui before the end of the first quarter of 2020. There are at least two reasons the aggregator fell short of this goal:

- First, enrollment started up slower than expected due to delays in finalizing the Participant Service Agreement document.
- Second, and more important, water heater installations were put on hold in mid-March 2020 because of the COVID-19 pandemic and government restrictions on business activities. During this time, many property managers were not allowing service contractors into residents' homes unless the contractors were providing services essential to residents' safety. The GSPA aggregator was

able to resume installations in September and has continued to install new devices through the beginning of November.

To enroll customers, the GSPA aggregator collaborates with larger commercial real estate management companies to tailor marketing to the tenants in each building. This marketing process is described at greater length in the text just below. The GSPA aggregator targets HECO customers in both master metered and individually metered buildings for enrollment.

The aggregator developed a separate approach for enrolling customers in master metered multifamily buildings versus those in individually metered multifamily buildings:

- Master metered buildings only require one service agreement (as opposed to separate agreements for each tenant), easing the enrollment process. Building owners or managers are responsible for disseminating demand response participation information to tenants and obtaining their agreement to participate. The drawback to this approach was that the GSPA aggregator primarily interacted with the building owner or manager, limiting their direct engagement and opportunity to form relationships with the building tenants.
- In individually metered multifamily buildings, each customer must sign an agreement to participate. At the beginning of enrollment, the GSPA aggregator was able to leverage existing relationships with managers of two individually metered multifamily residences in Oahu. The aggregator installed control devices prior to having customers sign a service agreement and having HECO approve their participation, expecting that this pre-approval and installation would accelerate enrollment. However, when it was time to enroll, many participants could not provide the information required to complete and process the service agreement, specifically the three different identification numbers (account number, meter number, and contract number). Most prospective participants did not have an online presence with HECO and could not look up their information. Customers who did provide all three numbers frequently recorded them in error, requiring the aggregator to circle back with these participants, occasionally multiple times, to correct the identification numbers (potentially at the expense of customer satisfaction).

Overall, in the two multifamily buildings with individually metered apartments, roughly 50% of tenants provided complete and accurate data to the aggregator. To facilitate enrollment of the remaining customers, the aggregator provided an option for tenants to upload photos of their documents for the aggregator to process. However, this process was labor-intensive for both the participant and the aggregator.

In consideration of these enrollment challenges and to avoid stranding assets or removing control devices, the GSPA aggregator stopped pre-approving participants and installing control devices before customer enrollment. Now, customers must successfully enroll before the aggregator installs a control device on their water heater. In addition, HECO and the aggregator developed a solution to avoid having customers provide their account number, meter number, and contract number. Now, participants are required only to provide their account number, and HECO looks up the meter and contract numbers.

In Maui, the aggregator has installed control devices on just two water heaters. Due to COVID-19 travel and quarantine restrictions and overall sentiment by property managers, recruitment on Maui is on hold, but expected to ramp up in spring 2021, if local conditions allow.

Low-Income Customers

The aggregator attempted to enroll primarily low- and middle-income customers (those who are asset limited and income constrained but employed) in water heater demand response grid services.[2] Such customers present several barriers to enrollment: English is commonly not a customer's primary spoken language, it can be difficult to contact the household decision maker, and customers are not always interested or engaged in managing energy consumption. The aggregator attempted to overcome these barriers using several strategies:

- ***Building trust****:* The aggregator seeks to engage each utility customer through the building manager, who has a relationship with the customer. The GSPA aggregator emphasized the importance of forging relationships (or "talking story") with potential enrollees.
- ***Employing resonant messaging****:* The GSPA aggregator tailors the marketing collateral to emphasize messaging most likely to resonate with customers in each building. This "hyper-local" marketing approach includes translating the marketing collateral into multiple languages.
- ***Going analog****:* Many enrollees do not have a strong digital presence, which makes it more difficult to reach and enroll them. The GSPA aggregator has largely used paper collateral to market the GSPA to potential participants.
- ***Simplifying the enrollment process****:* As noted above, individually metered customers were originally required to provide an account number, meter number, and contract number to enroll. The GSPA aggregator worked with HECO to simplify the enrollment process and reduce the burden on customers, who now only need to supply their account number.

Residential PV/Battery Storage Systems and Commercial Battery Demand Response

Despite the delays in GSPA implementation, the aggregator remains committed to meeting the demand reduction targets outlined in the GSPA, which specifies a combined 17.8 MW of Oahu grid services and 2.5 MW in Maui. The aggregator reported that implementation of demand response grid services from residential PV/battery storage systems is delayed due to the COVID-19 pandemic, and that grid services from these systems will be supplied by a different subcontractor.

The implementation of demand response grid services from commercial PV/battery storage systems is also delayed due to COVID-19 travel restrictions that have prevented key personnel from travelling to Maui and Oahu. However, OATI still plans to enroll five campuses at the University of Hawaii community colleges, with the initial systems projected to be enrolled in the first and second quarters of 2021.

[2] To the present, HECO's EnergyScout residential direct load control program for water heaters (~34,000 enrolled) and air conditioners (~4,000) have focused on enrollment of single-family customers, who tend to have higher incomes.

Customer Satisfaction

The aggregator's objective is to give low- and middle-income customers the opportunity to participate in water heater demand response without inconveniencing them. After the control device is installed and activated, the main source of participant inconvenience could be a shortage of hot water during capacity reduction and FFR events. The best approach to assess customer satisfaction is to survey participating customers about their installation and participation experiences. Both HECO and the aggregator plan to survey participants after achieving the target enrollments.

The aggregator did say that, to date, they have not received any complaints about cold water, which suggests that participants have not been adversely affected during grid services events. Also, the aggregator said that building managers and participants have received the demand response grid services opportunity enthusiastically because of the opportunity to contribute to decarbonizing Hawaii's power supply while reducing their energy bills, particularly for economically vulnerable populations. Another benefit for consumers is that the aggregator partnered with Hawaii Energy to deliver energy efficiency (such as home energy kits and home audits) and demand response to HECO customers.

Evaluation

RCTs are the gold standard, best practice approach for evaluating the impacts of demand response programs. Cadmus recommended that HECO evaluate the GSPA water heater demand response grid services using a RCT because such an approach is usually easy to implement and would allow for an accurate measurement of the demand response grid services. In particular, the RCT has advantages over other approaches for measuring the impacts of water heater FFR because of the short event durations:

- A baseline can be established using the demand of a control group of water heaters during events, allowing HECO to measure the impacts of the FFR and other grid services; with such a RCT, it is not necessary to construct the baseline using data on the electricity demand of participating water heaters on non-event days.
- In addition, the RCT is robust to electricity consumption changes induced by the pandemic. The baseline provided by the control group provides a valid counterfactual for measuring the impacts of grid services events on hot water consumption, even during periods of abnormal home occupancy patterns due to government stay-at-home orders.

HECO and the GSPA aggregator agreed to implement a RCT that will last for a minimum of three months or until HECO and the aggregator agree to terminate the RCT, whichever comes first. To facilitate implementation of the RCT, Cadmus agreed to randomly assign GSPA residential water heater customers into treatment and control groups and to conduct a statistical power analysis to ensure that the expected grid services impacts can be detected through statistical analysis.

As of November 2020, the RCT implementation has been delayed while HECO and the GSPA aggregator sign the new agreement that includes the implementation details. When an agreement is reached, Cadmus will work with HECO and the aggregator to implement the RCT.

The foregoing document was electronically filed with the State of Hawaii Public Utilities Commission's Document Management System (DMS).